Chapter 8

THE ANGLE

When you open or close a door, then the door makes different angles with the wall or its frame in different situations. If the body be considered as a straight line and the hand as another straight line then while doing physical exercises, the hand makes different angles with respect to the body when we rotate the hand in various directions.

In our daily life we come across many examples when we observe angles being made like the angle between the two hands of a clock, the angle between the two blades in a pair of scissors etc.

Note down some other such examples of angles being made in your notebook.



Let us observe some examples of angles.

In all the above figures the bigger (minute) hand of the clock is at 12 which the smaller (hour) hand is at different situations. In figure 1, the inclination between the two hands of the clock is less but the rotation between the hands is seen to increase gradually in fig. 2, 3 and 4.

Similarly, while using a pair of scissors, the inclination between the two blades becomes lesser than the state of beginning to use it. While taking your food, you must have noticed that your elbow turns at different angles to make it possible for you to take food on to your mouth from the plate.

Thus,

An inclination or turn between two arms or line segments at a point is known as an **angle**.

Similarly, when two line segments or rays cross or intersect each other, then the turn or inclination between those line segments are known as *angles*.

In which of figures given below. Do you find angles made?



In the above diagrams you can see that fig5 makes an angle, but fig8 does not make an angle, though there is a turn. This is because, none of the two arms is a straight line.

This means an angle can occur only when there is a turn between two straight lines or line segments. Can you now tell which other figures do not represent angles?

ACTIVITY 1

Look at the anlges represented in the Hindi letter ' \overline{A} ' and the letter 'A' of the English alphabet, like those, shown in the figures below and try to find out whether angles are represented in other letters of the alphabet in Hindi and English as you write them down.



 Figure
 Number of angles

 (15)
 (16)

 (17)
 (17)

Observe the figures and say how many anlges do you see in each of the figures?





By this time you must have started recognizing angles and have come to understand how anlges are formed. Can you now say, what are the conditions necessary for the fomation of an angle?

Every angle has two arms that meet at a point. The point at which the two arms meet is known as the **vertex** of the angle.

For example, look at the angle AOB (fig 18). OA and OB are the two arms that meet at O. The turn that

the arm OB has taken from the direction of OA is the way angle AOB has been formed. An angle is represented by this symbol \angle . Thus angle AOB would be written as $\angle AOB$.

Reading Angles by their Names



In figure 19, we can read or write the angle formed as \angle PQR or \angle RQP. In figure 20, the angle is \angle XYZ or \angle ZYX. What is the name of the angle in fig 21?

Remember that the point at B which angle is formed is known as its *vertex*. While reading or writing the name of an angle, the position of the vertex is always kept in the middle. Thus, we read the angle in fig 21 as $\angle ABC$ or $\angle CBA$.

ACTIVITY 3

In the figures given below, write the names of the angles in both ways in the space provided. $\sim A$



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Figure Number	Name of the angle
22	$\angle AOB \text{ or } \angle BOA$
23	
24	
25	
26	
27	
28	

Measuring the Angle

ACTIVITY 4

Let us do an activity. Take two sticks of broom or two bamboo sticks. Keep one end of



one stick over the other and fix a pin at that point. Here's your angle-making *apparatus*. Now if you rotate one of the sticks, keeping the other fixed at one position, you will get angles of different values. Let us think about some such possibilities.

Fig 29











THE ANGLE

Keeping OB fixed, if OA is rotated, the value of the angle would increase with increase in the turn of OA. Therefore, $\angle AOB$, $\angle A'OB$, $\angle A'OB$.

Show your teacher, the smallest angle or the biggest angle you can make with the help of your angle making apparatus.

Which is the largest angle among the pairs of figures given below?



Is $\angle LMN > \angle OPQ$? Give reasons.

In such a state when we cannot say whether an angle is greater or smaller just by looking at it, we measure the angle with the help of a protractor and find out which of them is greater.

Now look at your protractor. On its curved side marks are put at equal distances. Count them and find out how many divisions are marked. Try to identify the divisions that show different values and notice their positions.

Now let us draw an angle of a particular measure. You must have drawn angles in your notebooks in Class V. To draw an angle, we need a scale and a protractor. Take out the protractor from your geometry box and look at the divisions marked on its curved surface. Write the total number of divisions in your notebook.

Just as we use units like metre and centimetre to measure lengths, similarly the angle between two line segments is measured with the help of an unit known as degree. We represent it like this :

$$45 \text{ degree} = 45^{\circ}$$
$$22.5 \text{ degree} = 22.5^{\circ}$$

ACTIVITY 5

Let us know something more about 'degree'. Draw a long straight line on a plane paper or on a plane page of your notebook. Put the base of the protractor on the line in such a way that the middle of the protractor comes in the centre of the line drawn. Draw the outer edge of the protractor with your pencil along the surface moving from 0° to 180° as in fig 36.

On removing your protractor, you will find a figure as shown in fig 37. Now, keep the protractor on the base line in a way that the curved surface is just opposite to the previous



position. Draw the surface along the curved edge for 0° to 180° with the help of your pencil as shown in fig38. You will now get a figure as shown in fig39. When you remove your protractor.



On the basis of this figure, answer the following questions, now.

- (1) The angle formed at the centre of one semicircle (fig 37) = 180°
- (2) The angle formed at the centre of the second semicircle (fig 38) = ?
- (3) The complete angle formed at the centre of both the semicircles =?

You will find that the first semicircle makes an angle of 180° and the second semicircle also make an angle of 180° , so both together make an angle of 360° at the centre. This point is also the centre of the circle that is made by both the semicircles.

If you fold a circular piece of paper in a way that the circle gets divided into two equal parts, you'll find that a straight line passes through the centre point O, which makes an angle of 180° . This is also known as the *straight angle*.

Can you tell, how many such straight angles can be formed at the centre of a circle?

You have got a straight angle by folding a circular piece of paper into half. Now fold it in such a way that the circle gets divided into four equal parts.







Now the circle has been divided into 4 equal parts at the point O. Now find out the measures of the four angles that you can see at point O separately. How much is it?



Make five different angles of five measures in your notebook. Measure them yourself and let your friends measure them too, so that the measures get checked.

In order to draw an angle with the help of the protractor, first a straight line AB in drawn. The point O on the straight line at which the angle is to be drawn, is taken as the centre and the protractor is kept on it in such a way that the base line of the protractor falls on the straight line drawn in your notebook. Now move ahead from the point on your protractor where 0° is written. Put a point at the mark/division for the measure that you want your angle to be drawn. Suppose, you are drawing an angle of 60° . Then you would move from mark 0° towards 60° and put a point at that mark along the protractor. Now remove the protractor and join that point to the point O on the straight line with you pencil. Now you have $\angle POB = 60^{\circ}$, i.e. an angle POB of 60° .



ACTIVITY 6

You have been given some lines below. At the point shown on each line, draw the angle that have been mentioned below the figures. The first one is done for you.





Fig 49

On which points in the figures, did you draw the angle and in which direction to 0° did you move to draw them?

Figure No.	Point at which the angle is formed	The point that shows on which side of 0° the measure began
45	0	В
46		
47		
48		
49		

THE ANGLE

Note : Do you know that while doing physical exercise, when you stand at attention, the angle between your heels should be 30° ?

Find out some more such information.

ACTIVITY 7

Write down the length of arms and the measure of the angle for the given names in the table according to the figures.







Figure No.	Name of the angle	Measure of the angle	Arms that make the angle		Measures of the arms	
50	∠ A O B	43°	O A	OB		
50	∠ C O D		O C	O D		
50	∠ E O F		OE	O F		
50	∠ AOF		O A	O F		
50	∠ E O B		OE	OB		
51	\angle L Q M		QL	QM		
51	$\angle PQR$		Q P	QR		
51	$\angle PQS$		QP	QS		
51	∠ L Q R		QL	QR		

Is $\angle COD > \angle AOF$, Is $\angle EOF > \angle COD$, If no, why? (1)

(2)Does the measure of the angle depend on the legth of its arms?

On what does the greater or lesser degree of an angle between two arms depend? (3)

ACTIVITY 8

In fig 52, measure the angle x° and y° with the help of your protractor. Is $x^{\circ} = y^{\circ}$? Note it down in your notebook.

ηY

≻x

Y°

0

It is clear from the activities that the measures of angles, do not depend on the measure of the arms that make the angle because they can be made by straight lines or rays which can be extended endlessly. Both the lines are made up of several points. Therefore, the distance between any two points between two straight lines does not make an angle.









Types of Angles

Can you say when it is exactly 12 o'clock in your watch or on the clock, what is the measure of the angle between the smaller and the bigger hand?



Can you tell, how many times will the hour hand overlap the minute hand of your clock in 12 O'clock in 12 hours?

Think about the fact, that when the two hands overlap ecah other, what will be the angle between the two?

Just like the clock hands, when one ray overlaps the other, the angle between both of them is zero degree. Now look at your watch at 2:45 and tell what would be the measure of the angle between the hour hand and the minute hand at this time?

In fig 54 $\angle AOB = 0^{\circ}$, that is line segment OA is just over line segment OB, so that the turn between them is 0° . What will be the value of $\angle BAO$ in fig 55.





And in fig 55 OA and OB are line segments in opposite directions, so that they make a bigger line segment and then $\angle AOB = 180^\circ$, which is known as a *straight angle*.

(2) Straight Angle: The angle which measures 180° is known as a *straight angle*.



(3) Acute Angle: The angle which is more than 0° and less than 90° , is called an *acute angle*.



(4) **Right Angle:** The angle which measures 90° is known as a *right angle*. One arm of a right angle is perpendicular to the other arm.



(5) **Obtuse Angle:** The angle which measures more than 90° but less than 180° is known as an *obtuse angle*.



(6) **Reflex Angle (wide angle):** The angle which measures greater than a straight angle 180° but less than 360° is known as a *reflex angle*.



(8) Complete Angle: If a ray takes one complete turn or rotates round its end point to complete one full rotation and comes back to fall over its initial portion, then the angle it would make would be a full circle or a *complete angle*.



ACTIVITY 9



EXERCISE 8.2

- 1. Find out the statements that are true correct the false statements.
 - (i) A straight angle is 180° .
 - (ii) An obtuse angle measures more than 180° .
 - (iii) An acute angle is less than 90° .
 - (iv) At three o'clock, the hour and minute hands of a clock makes a right angle.
- 2. Identify the acute angle, right angle, obtuse angle and straight angle from the following:

(i)	120°	(ii)	30°	(iii)	90°	(iv)	180°
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- (v) 70° (vi) 105° (vii) 72° (viii) 36°
- (ix) 15° (x) 75° .
- 3. Compare the pairs of angles by measuring them:



What Have We Learnt?

- 1. The turn or inclination between two arms is known as the measure of an angles.
- 2. The unit to measure an angle is known an a degree. It is indicated by a small $^{\circ}$, at the top of a number e.g. 30° , 45° , 90° , 180° , 360° .
- 3. An angle whose measure is :

 0° is known as a zero angle.

Between 0° - 90° is called an acute angle.

Equal to 90° is a right angle.

Between 90° - 180° is called obtuse angle.

180 is called a straight angle.

Between 180° and 360° is known as a reflex angle.

 360° is called a complete angle.